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# Solving Inequalities Using Multiplication or Division

Unit 3 Lesson 3

## **SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION**

**Students will be able to:**

solve linear inequalities by using multiplication and division.

**Key Vocabulary:**

- Multiplication Property of Inequalities
- Division Property of Inequalities

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### MULTIPLICATION PROPERTY OF INEQUALITIES

#### A. For multiplying a positive number

*“If each side of a true inequality is multiplied  
by the **same positive number**,  
the resulting inequality is also true.”*

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### MULTIPLICATION PROPERTY OF INEQUALITIES

#### A. For multiplying a positive number

If  $a$ , and  $b$  are any numbers and  $c$  is a positive number, the following are true:

1. If  $a > b$ , then  $ac > bc$ .

$$12 > 9 \quad 12 \cdot 4 > 9 \cdot 4 \quad 48 > 36$$

2. If  $a < b$ , then  $ac < bc$ .

$$16 < 22 \quad 16 \cdot 2 < 22 \cdot 2 \quad 32 < 44$$

3. If  $a \geq b$ , then  $ac \geq bc$ .

$$10 \geq 9 \quad 10 \cdot 3 \geq 9 \cdot 3 \quad 30 \geq 27$$

4. If  $a \leq b$ , then  $ac \leq bc$ .

$$14 \leq 15 \quad 14 \cdot 5 \leq 15 \cdot 5 \quad 70 \leq 75$$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 1:** Solve each inequality.

A.  $\frac{x}{8} \geq 6$

B.  $\frac{7}{5}a < -7$

C.  $\frac{y}{4} \leq 13$

D.  $\frac{2}{3}n > 4$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 1:** Solve each inequality.

A.  $\frac{x}{8} \geq 6$

$$\frac{x}{8} \cdot 8 \geq 6 \cdot 8$$

$$x \geq 48$$

B.  $\frac{7}{5}a < -7$

$$\frac{5}{7} \cdot \frac{7}{5}a < -7 \cdot \frac{5}{7}$$

$$a < -5$$

C.  $\frac{y}{4} \leq 13$

$$\frac{y}{4} \cdot 4 \leq 13 \cdot 4$$

$$y \leq 52$$

D.  $\frac{2}{3}n > 4$

$$\frac{3}{2} \cdot \frac{2}{3}n > 4 \cdot \frac{3}{2}$$

$$n > 6$$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### MULTIPLICATION PROPERTY OF INEQUALITIES

#### B. For multiplying a negative number

*“If each side of a true inequality is multiplied  
by the **same negative number**,  
the direction of the **inequality symbol must be reversed**  
so that the resulting inequality is also true.”*

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### MULTIPLICATION PROPERTY OF INEQUALITIES

#### B. For multiplying a negative number

If  $a$ , and  $b$  are any numbers and  $c$  is a negative number, the following are true:

1. If  $a > b$ , then  $ac < bc$ .

$$15 > 12 \quad 15(-4) < 12(-4) \quad -60 < -48$$

2. If  $a < b$ , then  $ac > bc$ .

$$19 < 25 \quad 19(-2) > 25(-2) \quad -38 > -50$$

3. If  $a \geq b$ , then  $ac \leq bc$ .

$$13 \geq 12 \quad 13(-3) \leq 12(-3) \quad -39 \leq -36$$

4. If  $a \leq b$ , then  $ac \geq bc$ .

$$17 \leq 18 \quad 17(-5) \geq 18(-5) \quad -85 \geq -90$$



## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 2:** Solve each inequality.

A.  $-\frac{5}{6}x \leq -15$

B.  $-\frac{2}{3}a > 18$

C.  $-\frac{y}{5} \geq \frac{6}{5}$

D.  $-\frac{n}{16} < \frac{3}{4}$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 2:** Solve each inequality.

A.  $-\frac{5}{6}x \leq -15$        $\left(-\frac{6}{5}\right)\left(-\frac{5}{6}\right)x \geq (-15)\left(-\frac{6}{5}\right)$        $x \geq 18$

B.  $-\frac{2}{3}a > 18$        $\left(-\frac{3}{2}\right)\left(-\frac{2}{3}a\right) < 18\left(-\frac{3}{2}\right)$        $a < -27$

C.  $-\frac{y}{5} \geq \frac{6}{5}$        $\left(-\frac{y}{5}\right)(-5) \leq \frac{6}{5}(-5)$        $y \leq -6$

D.  $-\frac{n}{16} < \frac{3}{4}$        $\left(-\frac{n}{16}\right)(-16) > \frac{3}{4}(-16)$        $n > -12$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 3:** Write and solve each inequality.

- A. One-seventh times a number is at least 15.
- B. The ratio of a number and 5 is more than 25.
- C. A negative number over 15 is greater than or equal to 5.
- D. A number divided by negative nine is less than or equal to negative two.

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 3:** Write and solve each inequality.

- A. One-seventh times a number is at least 15.

$$\frac{1}{7}x \geq 15 \qquad (7) \left( \frac{1}{7}x \right) \geq 15(7) \qquad x \geq 105$$

- B. The ratio of a number and 5 is more than 25.

$$\frac{x}{5} > 25 \qquad (5) \left( \frac{x}{5} \right) > 25(5) \qquad x > 125$$

- C. A negative number over 15 is greater than or equal to 5.

$$-\frac{x}{15} \geq 5 \qquad (-15) \left( -\frac{x}{15} \right) \leq 5(-15) \qquad x \leq -75$$

- D. A number divided by negative nine is less than or equal to negative two.

$$\frac{x}{-9} \leq -2 \qquad \left( \frac{x}{-9} \right) (-9) \geq -2(-9) \qquad n \geq 18$$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### DIVISION PROPERTY OF INEQUALITIES

#### A. For dividing a positive number

*“If each side of a true inequality is divided  
by the **same positive number**,  
the resulting inequality is also true.”*

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### DIVISION PROPERTY OF INEQUALITIES

#### A. For dividing a positive number

If  $a$ , and  $b$  are any numbers and  $c$  is a positive number, the following are true:

1. If  $a > b$ , then  $\frac{a}{c} > \frac{b}{c}$ .

$$12 > 9$$

$$\frac{12}{3} > \frac{9}{3}$$

$$4 > 3$$

2. If  $a < b$ , then  $\frac{a}{c} < \frac{b}{c}$ .

$$16 < 22$$

$$\frac{16}{4} < \frac{22}{4}$$

$$4 < 5\frac{1}{4}$$

3. If  $a \geq b$ , then  $\frac{a}{c} \geq \frac{b}{c}$ .

$$10 \geq 9$$

$$\frac{10}{5} \geq \frac{9}{5}$$

$$2 \geq 1\frac{4}{5}$$

4. If  $a \leq b$ , then  $\frac{a}{c} \leq \frac{b}{c}$ .

$$14 \leq 15$$

$$\frac{14}{2} \leq \frac{15}{2}$$

$$7 \leq 7\frac{1}{2}$$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 4:** Solve each inequality.

A.  $4n \leq -12$

B.  $15y > 90$

C.  $3a \geq -57$

D.  $2x < 5$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 4:** Solve each inequality.

A.  $4n \leq -12$        $\frac{4n}{4} \leq \frac{-12}{4}$        $n \leq -3$

B.  $15y > 90$        $\frac{15y}{15} > \frac{90}{15}$        $y > 6$

C.  $3a \geq -57$        $\frac{3a}{3} \geq \frac{-57}{3}$        $a \geq -19$

D.  $2x < 5$        $\frac{2x}{2} < \frac{5}{2}$        $x < 2\frac{1}{2}$



## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### DIVISION PROPERTY OF INEQUALITIES

#### B. For dividing a negative number

*“If each side of a true inequality is divided  
by the **same negative number**,  
the direction of the **inequality symbol must be reversed**  
so that the resulting inequality is also true.”*

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

### DIVISION PROPERTY OF INEQUALITIES

#### B. For dividing a negative number

If  $a$ , and  $b$  are any numbers and  $c$  is a negative number, the following are true:

1. If  $a > b$ , then  $\frac{a}{c} < \frac{b}{c}$ .

$$5 > 2 \qquad \frac{5}{-3} < \frac{2}{-3}$$

$$-1\frac{2}{3} < -\frac{2}{3}$$

2. If  $a < b$ , then  $\frac{a}{c} > \frac{b}{c}$ .

$$9 < 15 \qquad \frac{9}{-4} > \frac{15}{-4}$$

$$-2\frac{1}{4} > -3\frac{3}{4}$$

3. If  $a \geq b$ , then  $\frac{a}{c} \leq \frac{b}{c}$ .

$$3 \geq 2 \qquad \frac{3}{-5} \leq \frac{2}{-5}$$

$$-\frac{3}{5} \leq -\frac{2}{5}$$

4. If  $a \leq b$ , then  $\frac{a}{c} \geq \frac{b}{c}$ .

$$7 \leq 8 \qquad \frac{7}{-2} \geq \frac{8}{-2}$$

$$-3\frac{1}{2} \geq -4$$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 5:** Solve each inequality.

A.  $-2.4x \geq 3.6$

B.  $-7a < 35$

C.  $-3y \leq 7$

D.  $-5n > 125$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 5:** Solve each inequality.

$$\begin{array}{lll} \text{A.} & -2.4x \geq 3.6 & \frac{-2.4x}{-2.4} \leq \frac{3.6}{-2.4} & x \leq -\frac{3}{2} \end{array}$$

$$\begin{array}{lll} \text{B.} & -7a < 35 & \frac{-7a}{-7} > \frac{35}{-7} & a > -5 \end{array}$$

$$\begin{array}{lll} \text{C.} & -3y \leq 7 & \frac{-3y}{-3} \geq \frac{7}{-3} & y \geq -2\frac{1}{3} \end{array}$$

$$\begin{array}{lll} \text{D.} & -5n > 125 & \frac{-5n}{-5} < \frac{125}{-5} & n < -5 \end{array}$$

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 6:** Write and solve each inequality.

- A. Three times a number is less than or equal to 21.
- B. The product of twenty five and a number is at most nine.
- C. A negative number multiplied by six is greater than or equal to four.
- D. Thrice a negative number is at least 18.

## SOLVING INEQUALITIES USING MULTIPLICATION OR DIVISION

**Sample Problem 6:** Write and solve each inequality.

- A. Three times a number is less than or equal to 21.

$$3x \leq 21$$

$$\frac{3x}{3} \leq \frac{21}{3}$$

$$x \leq 7$$

- B. The product of twenty five and a number is at most nine.

$$25x \leq 9$$

$$\frac{25x}{25} \leq \frac{9}{25}$$

$$x \leq \frac{9}{25}$$

- C. A negative number multiplied by six is greater than or equal to four.

$$(-x)(6) \geq 4$$

$$\frac{(-x)(6)}{-6} \leq \frac{4}{-6}$$

$$x \leq -\frac{2}{3}$$

- D. Thrice a negative number is at least 18.

$$-3x \geq 18$$

$$\frac{-3x}{-3} \leq \frac{18}{-3}$$

$$x \leq -6$$